the stomach was considered the cause of the peritonitis, because of the history of a six months' period of indigestion and a loss of twenty-five pounds in weight during this period. Operation was advised and accepted.

Operation March 29, 1916, 3 P.M. Anesthesia: novocain and ether. Right rectus incision with transverse cut at upper angle; gelatinous fluid in peritoneal cavity. The perforation, about one-sixteenth inch in diameter, was found in a small annular cancer near the pylorus. Apparently the omentum had been loosely adherent to the opening. The opening was burned with the cautery and the area turned in with mattress sutures. The omentum was sutured over this region. Drains were carried to the region of the perforation and the right kidney fossa. The pelvis was drained through a suprapubic wound. The patient rallied from the anesthesia, but died about thirty-six hours after the operation. Postmortem examination was not permitted.

PROGNOSIS IN HEART DISEASE IN RELATION TO AURICULAR FIBRILLATION AND ALTERNATION OF THE PULSE.

BY PAUL D. WHITE, M.D.,
BOSTON, MASS.

(From the Medical Clinic of the Massachusetts General Hospital, Boston.)

IN the course of an investigation three years ago (1914) on the frequency of alternation of the pulse, interesting groups of cases were accumulated and studied with the polygraph and electrocardiograph. Three series of cardiac patients, comprising 100 each, were collected with relation to the type of pulse and cardiac rhythm shown. The first series was composed of cases with auricular fibrillation, the second of cases with alternation of the pulse and the third of cases with normal cardiac rhythm without alternation. Heart-block, auricular flutter and paroxysmal tachycardia were not included *per se*.

For study as to prognosis the groups of auricular fibrillation and pulsus alternans were subdivided, each into three classes. The patients with auricular fibrillation were subdivided into (*a*) those who showed aberrant ventricular complexes, the so-called "bundle branch block," (*b*) those who showed ectopic ventricular contractions and (*c*) those who had uncomplicated auricular fibrillation. Since some of these 100 cases had not been electrocardiographed they could not all be so grouped. The patients with alternation of the pulse were also subdivided as already reported in an earlier paper[1] into (*a*) those who had constant pulsus alternans, (*b*) those having marked alternation after premature contractions only and (*c*) those showing only slight alternation after premature contractions. It was believed that the greater the grade of alternation the worse the prognosis. All of the 100 patients with pulsus alternans had radial pulse tracings taken. The 100 patients with normal rhythm, also studied cardiographically, were not subdivided.

---

[1] White, P. D.: AM. JOUR. MED. SC., July, 1915.

At the present time, just three years after beginning to collect these series of cases and two years after finding the most recent case, I have looked up the patients in order to determine their present condition. The results of this investigation I have tabulated (see Table) and am reporting here briefly for what they are worth. About one-third of the patients have been lost sight of, but the results from the others are of interest and of value.

Condition.	Type.	Total.	Cases followed until present time.	Better.	Unchanged.	Worse.	Dead.	Per cent. dead of cases traced.
Alteration of the pulse	Constant	26	22	2	0	0	20	91.0
	Marked after premature beats	16	12	0	0	0	12	100.0
	Slight after premature beats	58	42	4	13	1	24	57.0
	Total of alternation	100	76	6	13	1	56	74.0
Auricular fibrillation	Cases electrocardiographed	69						
	(1) Aberrant ventricular complexes	5	4	0	0	0	4	100.0
	(2) With ectopic beats	11	7	1	1	0	5	71.0
	(3) Uncomplicated	53	35	2	18	4	11	31.0
	Cases not electrocardiographed	31	16	2	3	1	10	62.5
	Total of auricular fibrillation	100	62	5	22	5	30	48.0
Normal rhythm	No alternation, fibrillation, paroxysmal tachycardia, flutter or heart block	100	49	8	15	3	23	47.0

DISCUSSION. From a glance at the Table it is obvious that in these series pulsus alternans taken *in toto* give a much poorer prognosis than auricular fibrillation, but that auricular fibrillation as such adds little if anything to the gravity of prognosis in a case of heart disease. The higher grades of pulsus alternans are almost twice as grave as the slight degrees, *i. e.*, slight alternation following premature contractions, while between the two severe grades, constant alternation and marked alternation after premature contractions, there is little to choose, the mortality in such grades together being almost 100 per cent. (94 per cent.) within a period of three years. However, even the cases with slight alternation after premature beats have a mortality of over 50 per cent. within the three years and definitely higher than either the auricular fibrillation or the normal rhythm averages.

In the case of auricular fibrillation I have often wished that I might be able to pick out by graphic methods the more serious cases, as one can do in pulsus alternans, as I have shown above. By examining the Table one sees some clues which help one in this attempt. For this selection electrocardiograms are necessary. Patients who show auricular fibrillation complicated by aberrant ventricular complexes or by ectopic ventricular contractions have a much graver prognosis than the uncomplicated auricular fibrillation, much more than twice as grave, especially in the case of the aberrant ventricular complexes, where in my small group of cases the mortality was 100 per cent. within three years. Such a finding might be expected because the electrocardiograms indicate serious myocardial damage or irritability in the ventricles. Such diseased or hyperirritable ventricular muscle does not stand up under the strain of auricular fibrillation the way relatively healthy ventricular muscle does. It is probable that one may regard these two conditions complicating auricular fibrillation as important as the presence of pulsus alternans in the case of a non-fibrillating heart. In fact, one of the patients tabulated above as having aberrant ventricular complexes and auricular fibrillation combined had been seen by me before his heart became arrhythmic and a radial pulse tracing at that time showed pulsus alternans.

Further confirmation of these findings in larger groups of cases would be of interest. The prognostic value of electrocardiograms as well as of radial pulse tracings is brought out by this investigation, the former especially as regards auricular fibrillation and the latter as regards alternation of the pulse.

SUMMARY. 1. Three groups of 100 patients each, showing (1) pulsus alternans, (2) auricular fibrillation and (3) normal rhythm, have been studied with relation particularly to prognosis. A large number of each group has been followed for two or three years and the condition determined at the end of that time.

2. Seventy-four per cent. of the cases with pulsus alternans, 48 per cent. of the cases with auricular fibrillation and 47 per cent. of the cases with normal rhythm have died.

3. The higher grades of alternation of the pulse carry with them an especially high mortality, nearly 100 per cent. within three years.

4. The cases with auricular fibrillation complicated by aberrant ventricular complexes seem to be very fatal (100 per cent. in the present series), those cases with ectopic ventricular contractions complicating the fibrillation have a mortality almost as high as the total of alternation while uncomplicated auricular fibrillation has a surprisingly low mortality percentage.

I wish to thank all those who have helped me to follow the cases discussed in this paper, especially Miss Catharine Thacher for her painstaking work.